

Polynuclear aromatic hydrocarbons USEPA methods 525, 8100 and 8270

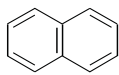
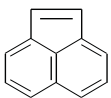
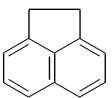
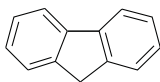
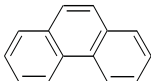
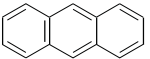
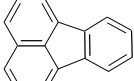
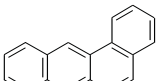
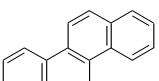
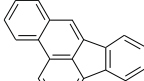
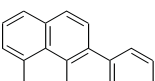
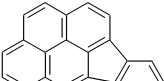
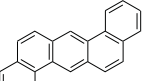
Introduction

Polynuclear Aromatic Hydrocarbons are hydrocarbons with multiple ring structures and are commonly referred to as PAHs or Polynuclear Aromatics (PNAs). Compounds within this class of pollutants are considered mutagenic, which has led to restrictions on their release into the environment. PAHs find their way into air, water and soil in a variety of ways, but the major source is the incomplete burning of fossil fuels. The burning of coal in power stations or petrol (gasoline) in cars, trains and trucks leaves a residual tar and is the primary cause of PAHs in densely populated areas. As such, there is a need to be able to detect PAHs in the environment. Particular attention is paid to the separation and quantitation of the 16 priority compounds (Figure 1) and especially the 4 critical pairs of PAHs (5 and 6; 9 and 10; 11 and 12; 14 and 15) in the USEPA methods 525, 8100 and 8270.

Our range of columns can achieve separation of the various PAH critical pairs. The 5% phenyl BPX5 column gives excellent separation of all 4 critical pairs with an analysis time for the 16 components of less than 26 minutes for conventional length columns and 13 minutes for fast columns (allowing a higher sample throughput and therefore higher

laboratory efficiency). The commonly monitored PAHs (5-6, 9-10, 11-12 and 14-15) are easily resolved on either the conventional or fast BPX column with excellent results. A resolution (R) value of >1.0 is satisfactory for quantitation with an R-value of 1.5 representing baseline separation. The 35% phenyl BPX35 column provides good separation of Benzo (a) anthracene (9) and Chrysene (10) (Figure 4) and the other critical pairs peaks 11-12 and peaks 14-15. For laboratories that already have a 100% methyl polysiloxane equivalent SolGel-1ms column, the separation of the 16 PAHs and in particular the 4 critical pairs can be easily achieved in less than 24 minutes. Figure 5 shows the separation of the most commonly monitored PAHs on a SolGel-1ms column. Note the baseline separation of the difficult Phenanthrene (5) and Anthracene (6) and also the low bleed profile at 325°C. This is the maximum temperature of the USEPA method 525. Figure 5 also shows excellent separation of other critical pairs; peaks 9-10, 11-12 and 14-15. The bleed profile of each chromatogram at 300°C or greater is excellent and all three columns are thermally stable to 370°C. This allows each column to be “baked out” without damage to the stationary phase, ensuring any high boiling contaminants do not interfere with the retention times and elevated baselines of target compounds in future analyses.

Figure 1. The GC elution order of PAH structures on BPX5.

1.		2.		3.		4.	
	Naphthalene (5.3)*		Acenaphthylene (7.7)*		Acenaphthene (8.1)*		Fluorene (9.1)*
5.		2.8**	6.		2.8**	7.	
	Phenanthrene (11.2)*		Anthracene (11.3)*		Fluoranthene (13.9)*		Pyrene (14.4)*
9.		1.9**	10.		1.9**	11.	
	Benzo(a)anthracene(17.2)**		Chrysene (17.3)*		Benzo(b)fluoranthene(19.6)*		Benzo(k)fluoranthene(19.7)*
13.			14.		1.2**	15.	
	Benzo(a)pyrene (20.5)*		Indeno(1,2,3-c,d) (24.1)*		Dibenz(a,h)anthracene (24.2)*		Benzo(g,h,i)perylene (25.2)*

* Denotes (approx. retention time in minutes)

** Denotes Resolution Factor

BPX5

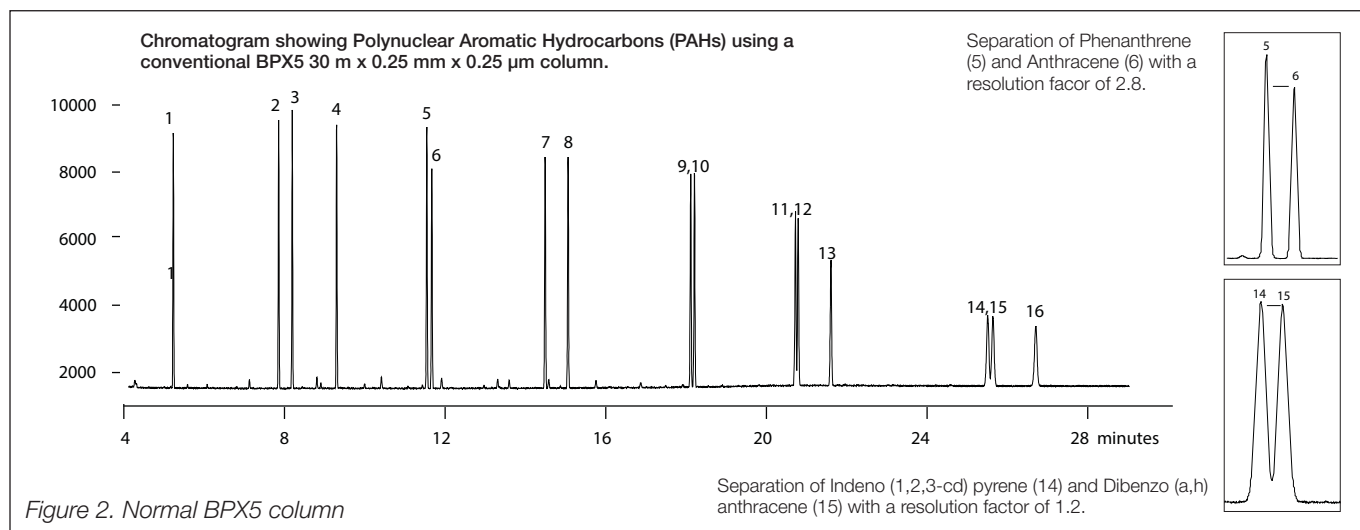
5% phenyl (equiv) polysilphenylene-siloxane

BPX5 replaces

DB-5	DB-5.625	Rtx-5ms	HP-5	HP5-TA	MDN-5S
DB-5MS	XTI-5	Ultra-2	HP-5MS	SPB-5	CP-Sil 8CB

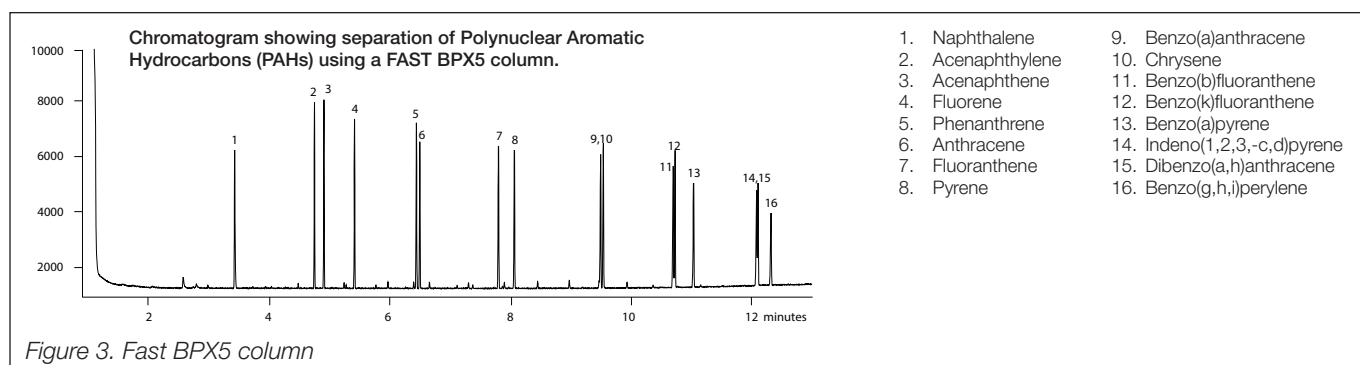
Conditions

Column part number	054101		
Phase	BPX5	Constant flow	On
Column	30 m x 0.25 mm x 0.25 µm	Average linear velocity	35 cm/sec at 65°C
Sample	5 ng/µL in dichloromethane	Injection mode	Splitless
Initial temperature	65°C, 1 min	Purge on time	0.5 min
Rate 1	25°C/min to 140°C	Purge on (split) vent flow	60mL/min
Rate 2	10°C/min to 290°C	Injection volume	1 µL
Final temperature	290°C, 11 min	Injection temperature	240°C
Detector	FID, 300°C	Autosampler	Yes
Carrier gas	He, 17.5psi	Liner type	4 mm ID Tapered FocusLiner
Carrier gas flow	1.5 mL/min		



Conditions

Column part number	054099		
Phase	BPX5	Constant flow	On
Column	10 m x 0.10 mm x 0.10 µm	Average linear velocity	40 cm/sec at 70°C
Sample	5 ng/µL	Injection mode	Splitless
Initial temperature	70°C, 1 min	Purge on time	0.5 min
Rate 1	30°C/min to 160°C	Purge on (split) vent flow	10 mL/min
Rate 2	20°C/min to 320°C	Injection volume	0.5 µL
Final temperature	320°C, 1 min	Injection temperature	240°C
Detector	FID, 320°C	Autosampler	Yes
Carrier gas	He, 45.1 psi	Liner type	2.3mm ID Tapered FocusLiner
Carrier gas flow	0.467 mL/min		



BPX35

35% phenyl (equiv) polysilphenylene-siloxane

Figure 4 shows excellent separation of other critical pairs; peaks 9-10, peaks 11-12, and peaks 14-15.

BPX35 replaces

DB-35	HP-35
DB-35MS	HP-35MS
Rtx-35	SPB-35
Rtx-35ms	MDN-35

Conditions

Column part number	054701		
Phase	BPX35	Constant flow	On
Column	30 m x 0.25 mm x 0.25 µm	Average linear velocity	37 cm/sec at 100°C
Sample	10 ng/mL in dichloromethane	Injection mode	Splitless
Initial temperature	100°C, 0.5 min	Purge on time	0.5 min
Rate	10°C/min to 325°C	Purge on (split) vent flow	60 mL/min
Final temperature	325°C, 15 min	Injection volume	1 µL
Detector type	MS	Injection temperature	250°C
Carrier gas	He, 10.5 psi	Autosampler	No
Carrier gas flow	1.0 mL/min	Liner type	4 mm ID Double taper

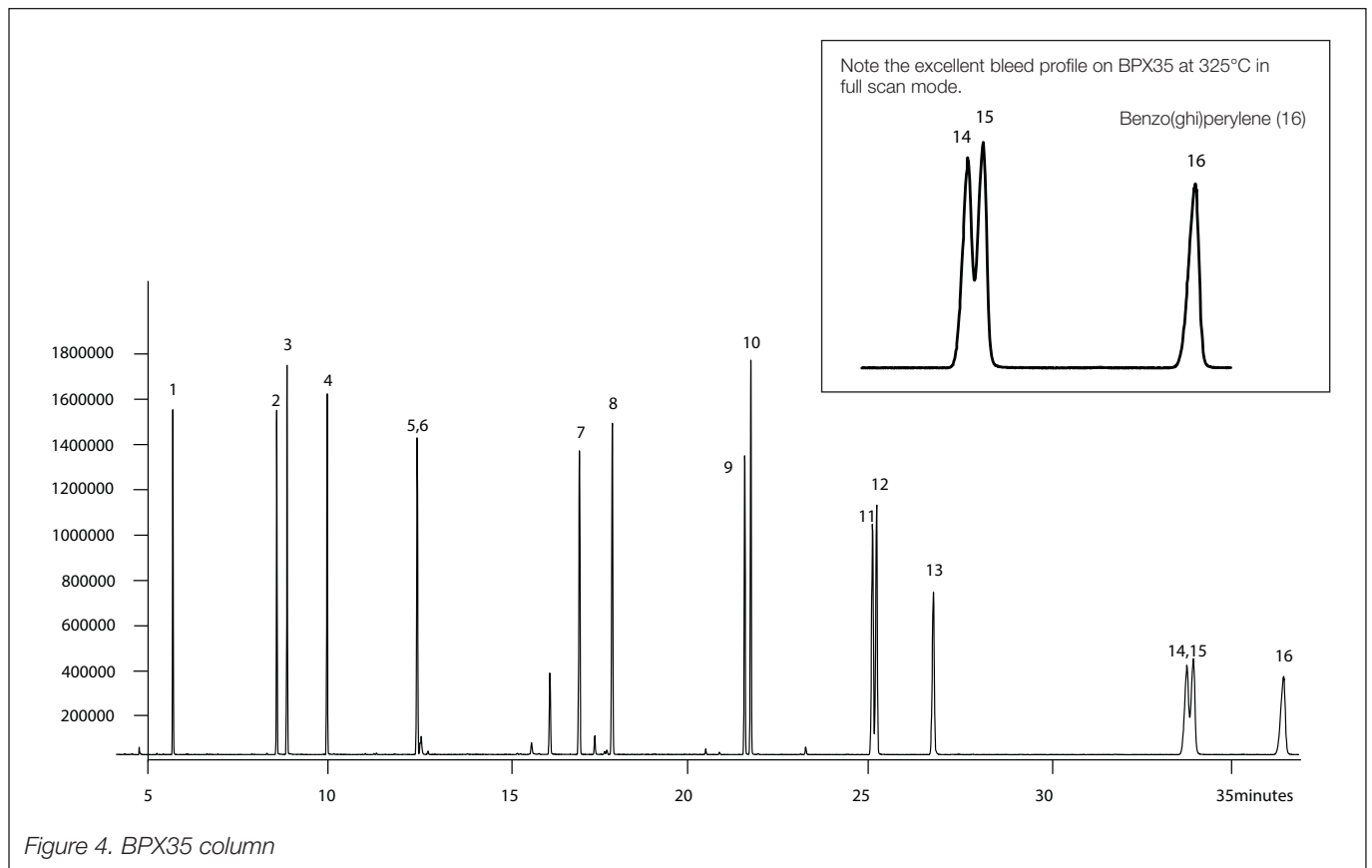


Figure 4. BPX35 column

SolGel-1ms

100% dimethyl polysiloxane (equivalent)

Figure 5 shows the separation of the most commonly monitored PAHs on a SolGel-1ms.

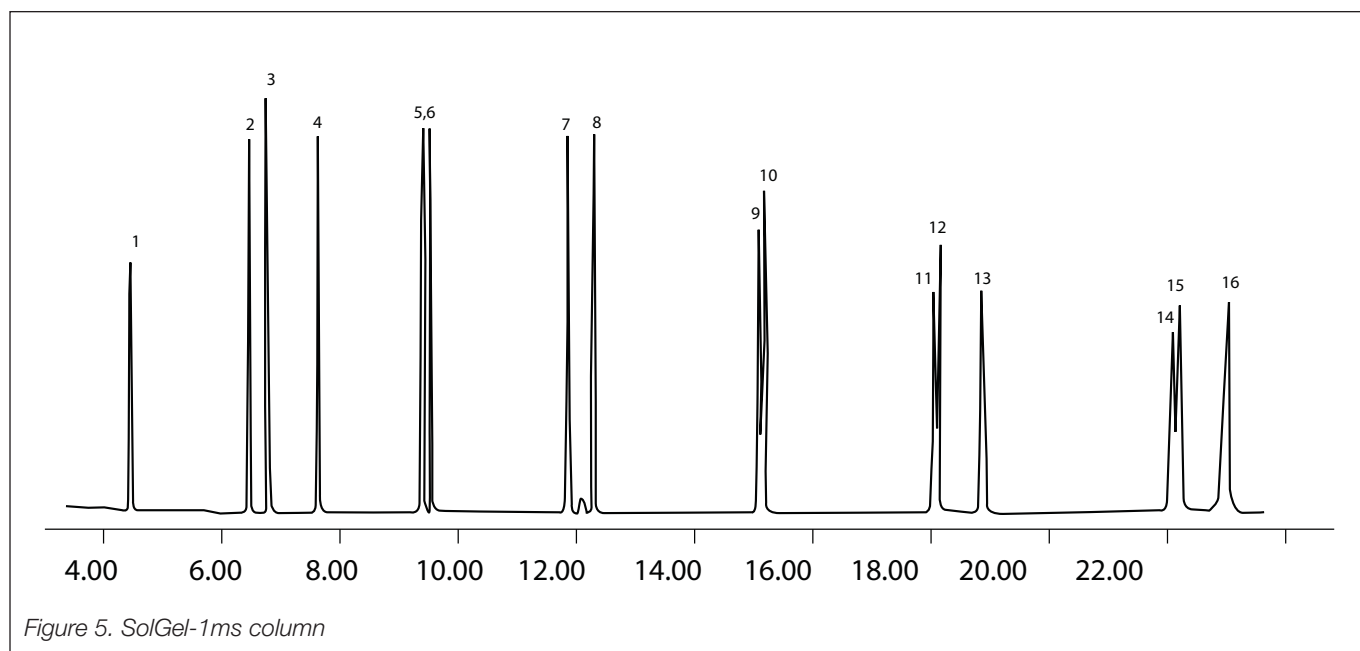
Note the excellent separation of peaks 14 and 15 as well as the superb bleed profile at 325°C.

BP1 (100% Dimethyl Polysiloxane) replaces

DB-1	Ultra-1
DB-Petro	SPB-1
HP-1	SPB-1 Sulfur
HP-1MS	Petrocol DH
Rtx-1	CP-Sil 5CB

Conditions

Column part number	054795		
Phase	SolGel-1ms	Constant flow	On
Column	30 m x 0.25 mm x 0.25 µm	Average linear velocity	39 cm/sec at 65°C
Sample	10 ng/mL in dichloromethane	Injection mode	Splitless
Initial temperature	65°C, 0.5 min	Purge on time	0.5 min
Rate 1	25°C/min to 140°C	Purge on (split) vent flow	60 mL/min
Rate 2	10°C/min to 325°C	Injection volume	0.2 µL
Final temperature	325°C, 15 min	Injection temperature	250°C
Detector	MS	Autosampler	No
Carrier gas	He, 9.7 psi	Liner type	4 mm ID Double taper
Carrier gas flow	1 mL/min		



Summary

The BPX5 column shows exceptional performance in the analysis of the 16 polynuclear aromatic hydrocarbons of the USEPA methods 525, 625, 8100 and 8270, achieving separation of all of the critical pairs in less than 26 minutes. The separation of select critical pairs can be achieved on SolGel-1ms and BPX35 with excellent

resolution. Each column is thermally stable to 370°C allowing bake out after analysis of any high boiling contaminants.

Information and support

Visit www.trajanscimed.com or contact techsupport@trajanscimed.com

Specifications are subject to change without notice.